

9 – Vincennes

Exceptional Events Detail

- Parameter: PM_{2.5}
- Dates: May 24, 27, & 30, 2007
- Location: Vincennes – Knox Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Knox County region during the period of May 24 – 30. The gradual buildup of smoke moving through the area during this period resulted in elevated levels of PM_{2.5} concentrations.
- Data: Different analyses of the data are used to demonstrate that the PM_{2.5} concentrations measured on May 24, 27, and 30 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 9.1 shows daily PM_{2.5} averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of ‘E’ in AQS, awaiting concurrence from EPA.

Tables 9.2 and 9.3 list summaries of the data collected at the SW Agricultural Center since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. Although the design value of the 98th percentile (2005-2007) remains the same at 36 ug/m³, there is an improvement in the mean design value (2005-2007) from 14.2 ug/m³ to 14.1 ug/m³.

The values recorded during the May 24-30 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May since 2000 had been 25.2 ug/m³ and the highest monthly average had been 13.9 ug/m³. With the high data collected in May 2007, the highest value was 29.5 ug/m³ and the monthly average was 19.5 ug/m³. Removing the flagged data results in a maximum daily concentration of 22.7 ug/m³ and an average concentration of 15.4 ug/m³. These values are much more in line with historical data.

**Table 9.1 - FRM Daily Values
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

| Date | SW Purdue Ag Center 180830004 |
|----------------|----------------------------------|
| 5/18/07 | 6.6 |
| 5/19/07 | |
| 5/20/07 | |
| 5/21/07 | 18.2 |
| 5/22/07 | |
| 5/23/07 | |
| 5/24/07 | 28.4 |
| 5/25/07 | |
| 5/26/07 | |
| 5/27/07 | 29.5 |
| 5/28/07 | |
| 5/29/07 | |
| 5/30/07 | 29.1 |
| 5/31/07 | |
| 6/1/07 | |
| 6/2/07 | 20.3 |

Table 9.2 - Historical Daily Values

| | | SW Purdue Ag Center 180830004 | |
|------|---------------|----------------------------------|---------------------------------|
| Year | | 98th %ile | Daily Design Value ¹ |
| 2000 | | 34.5 | |
| 2001 | | 33 | |
| 2002 | 2000- 2002 | 38.6 | 35 |
| 2003 | 2001- 2003 | 34.8 | 35 |
| 2004 | 2002- 2004 | 29.9 | 34 |
| 2005 | 2003- 2005 | 41.8 | 36 |
| 2006 | 2004- 2006 | 36.2 | 36 |
| 2007 | 2005- 2007 | 30.9 | 36 |
| | | Values excluding flagged data | |
| 2007 | 2005- 2007 | 30.9 | 36 |

¹Daily Design Value = 3 year average of annual 98th %ile values.

Table 9.3 - Historical Annual Averages

| | | SW Purdue Ag Center 180830004 | |
|------|-----------|----------------------------------|----------------------------------|
| Year | | Annual Ave. | Annual Design Value ² |
| 2000 | | 13.9 | |
| 2001 | | 13.4 | |
| 2002 | 2000-2002 | 14.2 | 13.8 |
| 2003 | 2001-2003 | 14 | 13.9 |
| 2004 | 2002-2004 | 12.6 | 13.6 |
| 2005 | 2003-2005 | 15.7 | 14.1 |
| 2006 | 2004-2006 | 13.2 | 13.8 |
| 2007 | 2005-2007 | 13.8 | 14.2 |
| | | Values excluding flagged data | |
| 2007 | 2005-2007 | 13.3 | 14.1 |

²Annual Design value = 3 year average of the annual averages.

Particulate

Composition: Speciated data are not collected at Vincennes. The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The values were among the highest values recorded in 2007. The elemental carbon values on these dates remained at or below average values.

The time progression of the maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

Maps:

Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until June 2. The daily wind roses generally track the direction of the smoke plume on that day at the local level. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the SW Indiana region.

Trajectory
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 38.74°; longitude: -87.48°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24 and 30 both show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Knox County region during the period of May 24 – 30, 2007 causing elevated levels of the PM_{2.5} 24-hour standard and increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 9.1.

NOAA Satellite Smoke Maps, Weather Maps And Wind Roses

The smoke map shows that the plume has reached the Knox Co. area and as shown in Table 9.1, PM_{2.5} levels have increased. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SW prevailing winds.

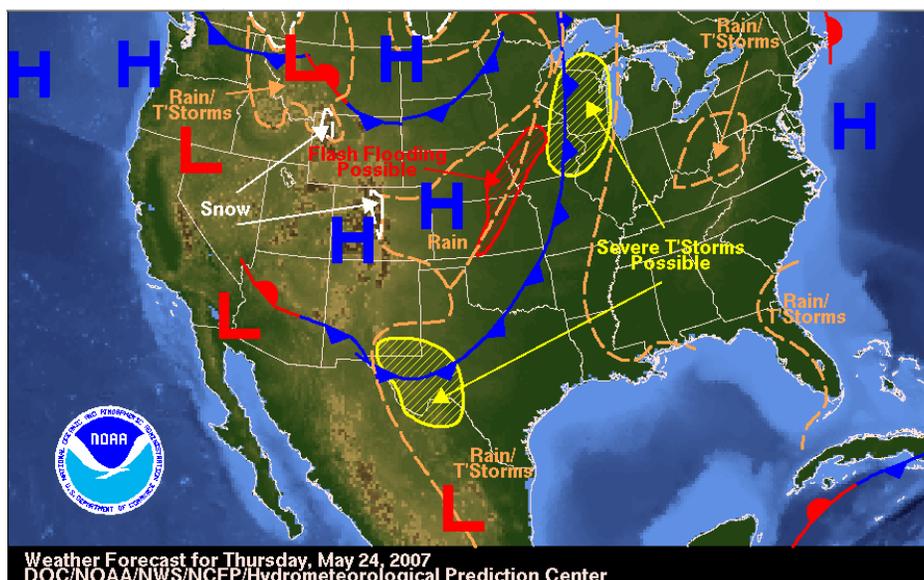
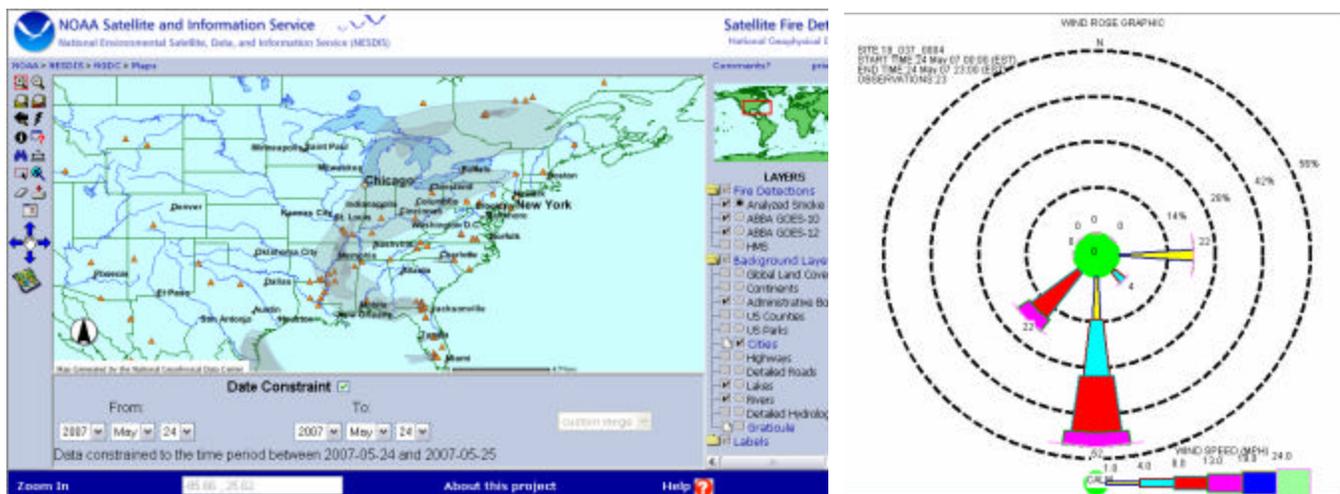


Figure 9.1 - May 24, 2007

The smoke map illustrates that the plume stalls as the trough keeps the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the PM_{2.5} levels to remain elevated.

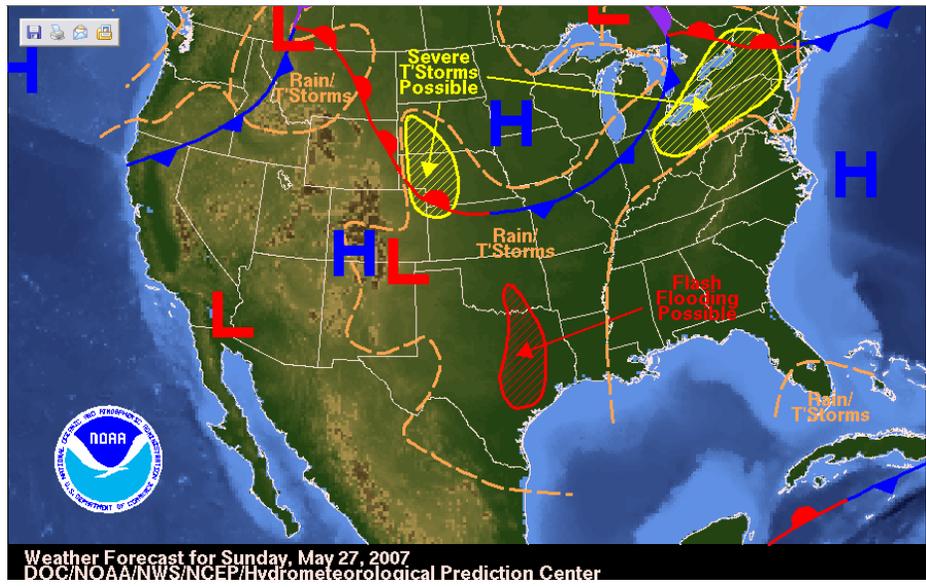
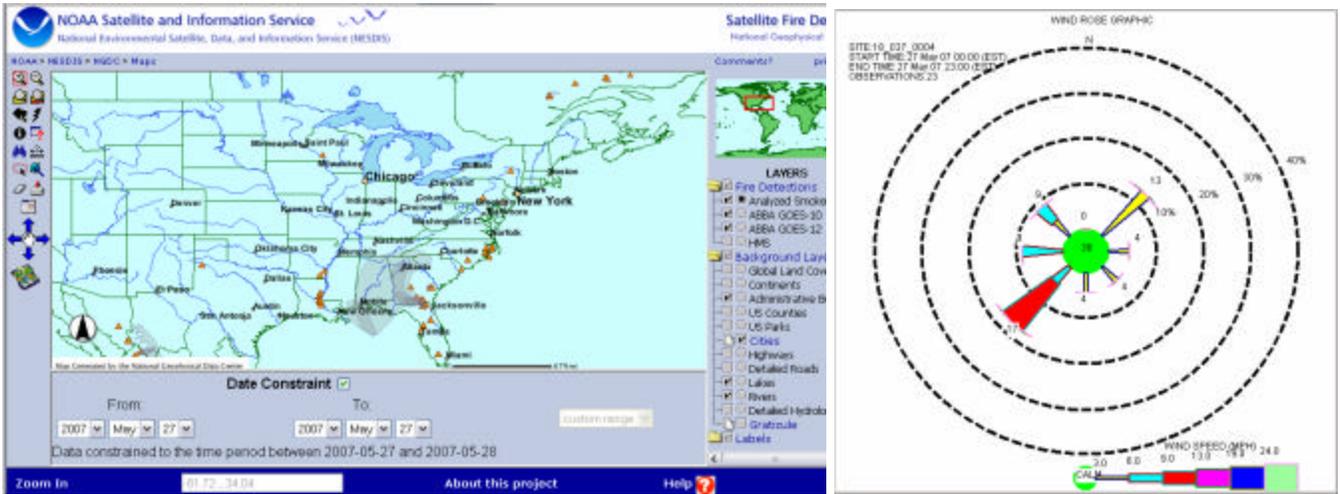


Figure 9.2 - May 27, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

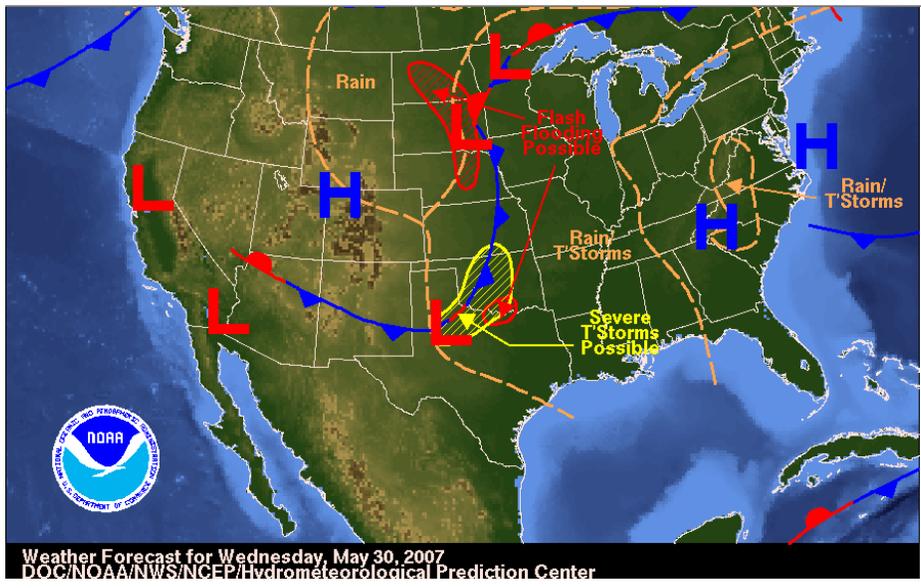
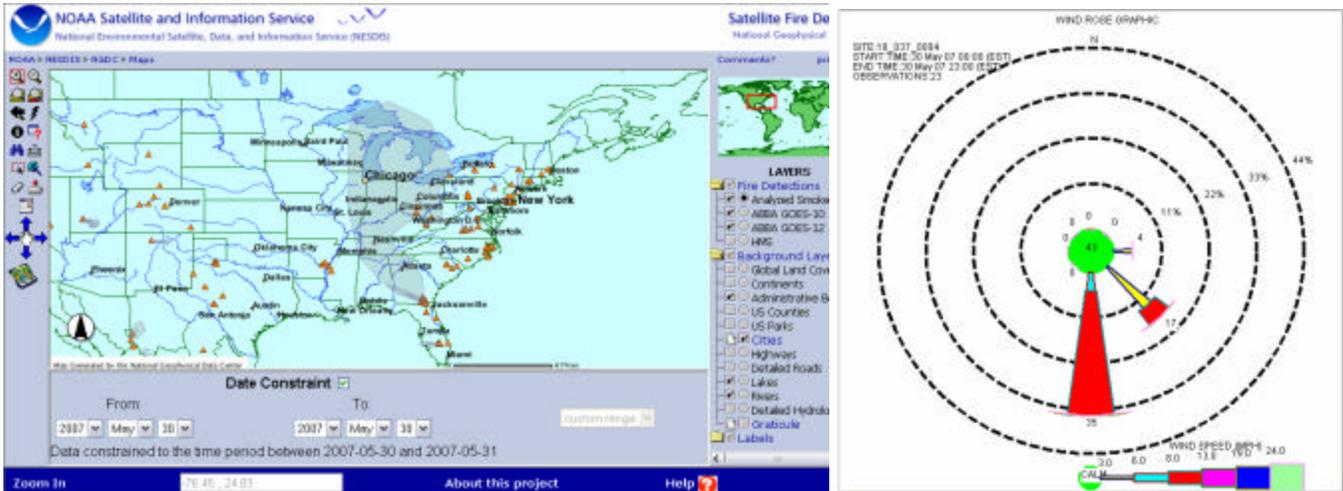


Figure 9.3 - May 30, 2007

Backward Trajectory Models

NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access vi a NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.

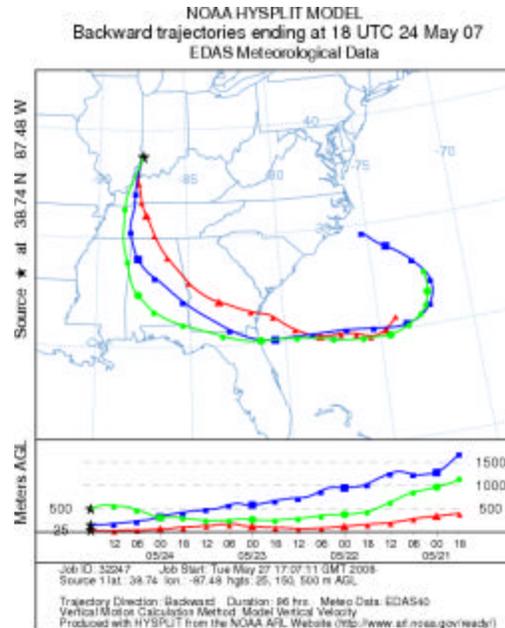


Figure 9.4: Backward trajectories originating from Vincennes on 5/24/07 at 12:00 PM CST showing the air mass passing over southern Georgia.

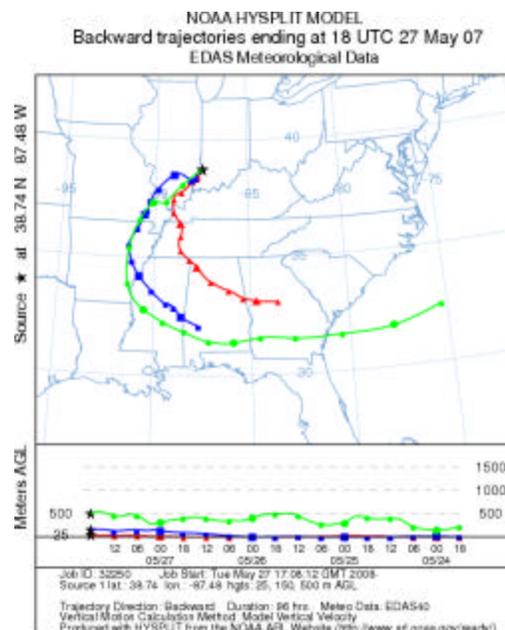


Figure 9.5: Backward trajectories originating from Vincennes on 5/27/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

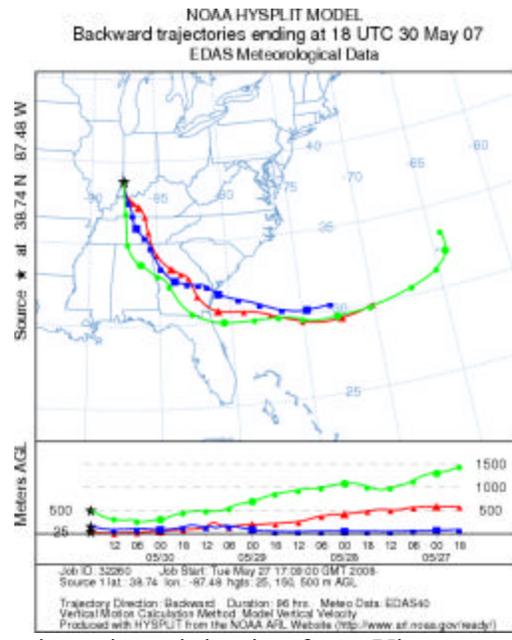


Figure 9.6: Backward trajectories originating from Vincennes on 5/30/07 at 12:00 PM CST showing the air mass still passing over Georgia.